

1. Let $p = \sin 40^\circ$ and $q = \cos 110^\circ$. Give your answers to the following in terms of p and/or q .

(a) Write down an expression for

(i) $\sin 140^\circ$;

(ii) $\cos 70^\circ$.

(2)

(b) Find an expression for $\cos 140^\circ$.

(3)

(c) Find an expression for $\tan 140^\circ$.

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(Total 6 marks)

2. Consider the arithmetic sequence 2, 5, 8, 11,

(a) Find u_{101} .

(3)

(b) Find the value of n so that $u_n = 152$.

(3)

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(Total 6 marks)

3. A particle moves along a straight line so that its velocity, $v \text{ ms}^{-1}$ at time t seconds is given by $v = 6e^{3t} + 4$. When $t = 0$, the displacement, s , of the particle is 7 metres. Find an expression for s in terms of t .

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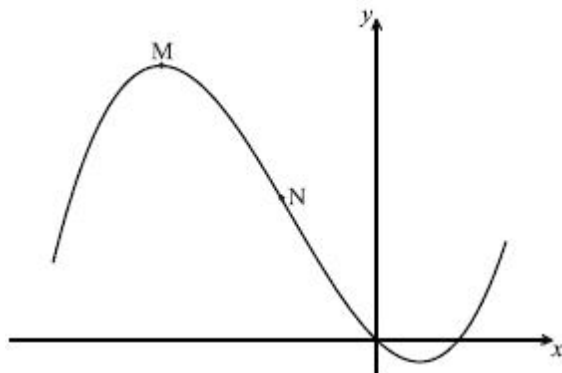
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(Total 7 marks)

4. Consider $f(x) = \frac{1}{3}x^3 + 2x^2 - 5x$. Part of the graph of f is shown below. There is a maximum point at M, and a point of inflexion at N.



- (a) Find $f'(x)$. (3)
- (b) Find the x -coordinate of M. (4)
- (c) Find the x -coordinate of N. (3)
- (d) The line L is the tangent to the curve of f at $(3, 12)$. Find the equation of L in the form $y = ax + b$. (4)

(Total 14 marks)

5. Let $f(x) = \ln(x + 5) + \ln 2$, for $x > -5$.

(a) Find $f^{-1}(x)$.

(4)

Let $g(x) = e^x$.

(b) Find $(g \circ f)(x)$, giving your answer in the form $ax + b$, where $a, b \in \mathbb{Z}$.

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(3)

(Total 7 marks)

6. A **four-sided** die has three blue faces and one red face. The die is rolled.

Let B be the event a blue face lands down, and R be the event a red face lands down.

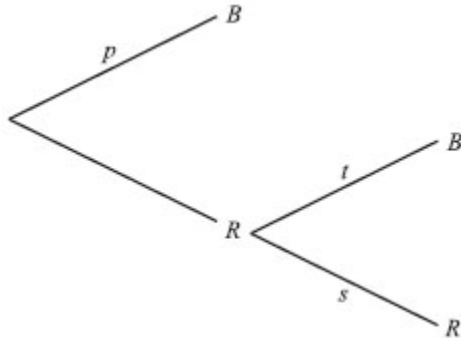
(a) Write down

(i) $P(B)$;

(ii) $P(R)$.

(2)

- (b) If the blue face lands down, the die is not rolled again. If the red face lands down, the die is rolled once again. This is represented by the following tree diagram, where p , s , t are probabilities.



Find the value of p , of s and of t .

(2)

Guisseppi plays a game where he rolls the die. If a blue face lands down, he scores 2 and is finished. If the red face lands down, he scores 1 and rolls one more time. Let X be the total score obtained.

- (c) (i) Show that $P(X = 3) = \frac{3}{16}$.

- (ii) Find $P(X = 2)$.

(3)

- (d) (i) Construct a probability distribution table for X .

- (ii) Calculate the expected value of X .

(5)

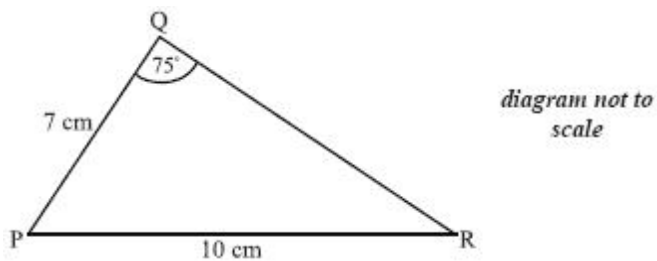
- (e) If the total score is 3, Guisseppi wins \$10. If the total score is 2, Guisseppi gets nothing.

Guisseppi plays the game twice. Find the probability that he wins exactly \$10.

(4)

(Total 16 marks)

7. The diagram below shows triangle PQR. The length of [PQ] is 7 cm, the length of [PR] is 10 cm, and \hat{PQR} is 75° .



- (a) Find \hat{PQR} .

(3)

- (b) Find the area of triangle PQR.

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(3)

(Total 6 marks)

8. Consider the points A (1, 5, 4), B (3, 1, 2) and D (3, k , 2), with (AD) perpendicular to (AB).

(a) Find

(i) \overrightarrow{AB} ;

(ii) \overrightarrow{AD} , giving your answer in terms of k .

(3)

(b) Show that $k = 7$.

(3)

The point C is such that $\overrightarrow{BC} = \frac{1}{2} \overrightarrow{AD}$.

(c) Find the position vector of C.

(4)

(d) Find $\cos \hat{ABC}$.

(3)

(Total 13 marks)